

DATE PREPARED: <p style="text-align: center;">June 25, 2007</p>	ISS PAYLOAD OFFICE PIRN/EXCEPTION FORM	PAGE 1 OF 8				
Doc. No., SSP 57213, Alpha Magnetic Spectrometer-02 Rev. & Title: Hardware ICD		PIRN No: <p style="text-align: center;">57213-NA-0007</p>				
TITLE: <p style="text-align: center;">AMS (Alpha Magnetic Spectrometer) – Thermal Exchange Between Payloads Exceedance</p>						
Originator: Name: Trent Martin Agency: NASA JSC AMS Project Office / EA Phone: 281-483-3296 Email: trent.d.martin@nasa.gov	PIRN Type: <div style="display: flex; align-items: center;"> <input type="checkbox"/> Standard PIRN <input checked="" type="checkbox"/> Exception </div>	FAX Approval Signatures to this Number: <p style="text-align: center;">314-777-2866</p>				
Utilization Change Engineer: Name: W C Bohannon Agency: Boeing PEI Phone: 281 226 4480 Email: william.c.bohannon@boeing.com	SSCN/CR N/A	RELATED PIRN No.: N/A				
Agency Tracking No.: 57213-0009	SYSTEM/ELEMENT AFFECTED & STAGE EFFECTIVITY: AMS attached to S3 upper Inboard – Launch through End Of Life					
REASON FOR CHANGE OR REQUIREMENT(S) VIOLATION: AMS exceeds specularly requirement defined in SSP-57003, Paragraphs 3.4.1.1.6-B.						
PARAGRAPHS, FIGURES, TABLES AFFECTED (For PIRN use only)						
<u>Page</u>	<u>Paragraph(s)</u>	<u>Figures(s)</u>	<u>Table(s)</u>	<u>R</u>	<u>A</u>	<u>D</u>
3-58	3.4.1.1.6-B	N/A	N/A			
AFFECTED INTERFACING PARTIES						
	SIGNATURE & ORGANIZATION	DATE	SIGNATURE & ORGANIZATION	DATE	SIGNATURE & ORGANIZATION	DATE
C O N C U R	/s/ Gene Cook/ OZ3	01/08/09	/s/ Trent Martin/ AMS	09/29/08	/s/ Robert Jones/ GSFC ELC	11/24/08
	/s/ Vic Sanders/ Boeing PEI	01/06/09	/s/ Eric Schaefer/ Boeing PTCS	10/04/08		
	/s/ Sharm Baker/ S&MA	10/10/08	/s/ John Iovine/ NASA PTCS	10/06/08		
	/s/ Rafael Garcia/ OB/ELC	11/24/08	/s/ Rod Jones/ PCB	01/16/09		
	/s/ Rodney Nabizadeh/ OM6	12/22/08				
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SSP 57003 Requirement:

3.4.1.1.6-B THERMAL EXCHANGE BETWEEN PAYLOADS

B. Attached Payload surfaces with a view to other Attached Payloads shall have specularities of 10% or less.

Proposed 57213 AMS Payload Exception:

3.4.1.1.6-B THERMAL EXCHANGE BETWEEN PAYLOADS

B. Attached Payload surfaces with a view to other Attached Payloads shall have specularities of 10% or less, **except the AMS payload has a specularities of greater than 10% for some surfaces with a view factor to the neighboring attached payload (thermal model available upon request). Figures 3.4.1.1.6-1-AMS, 3.4.1.1.6-2-AMS, and 3.4.1.1.6-3-AMS show the surfaces on AMS with a specularities greater than 10%.**

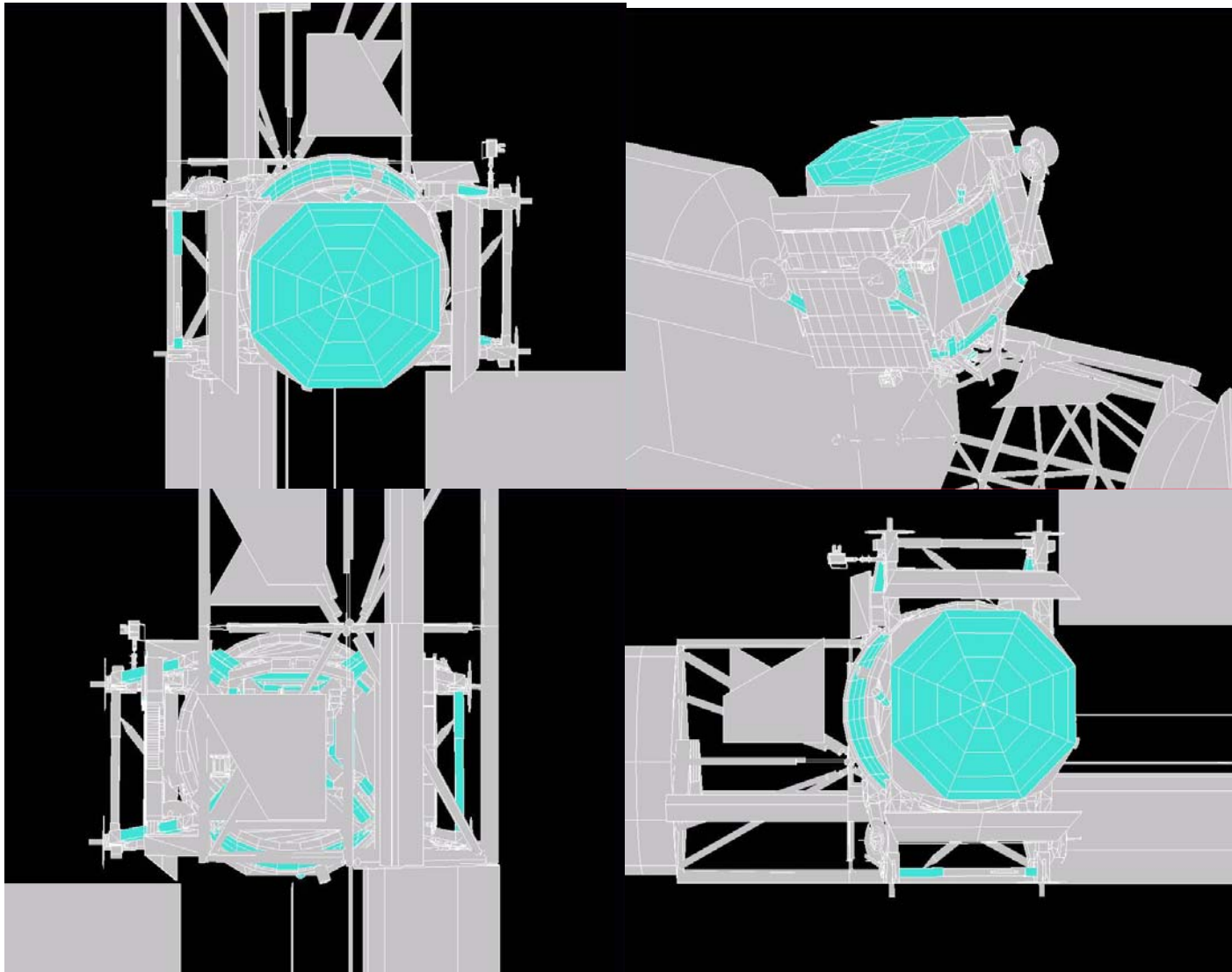


Figure 3.4.1.1.6-1-AMS: AMS Surfaces with Specularity Greater than 10% (shown in Green)

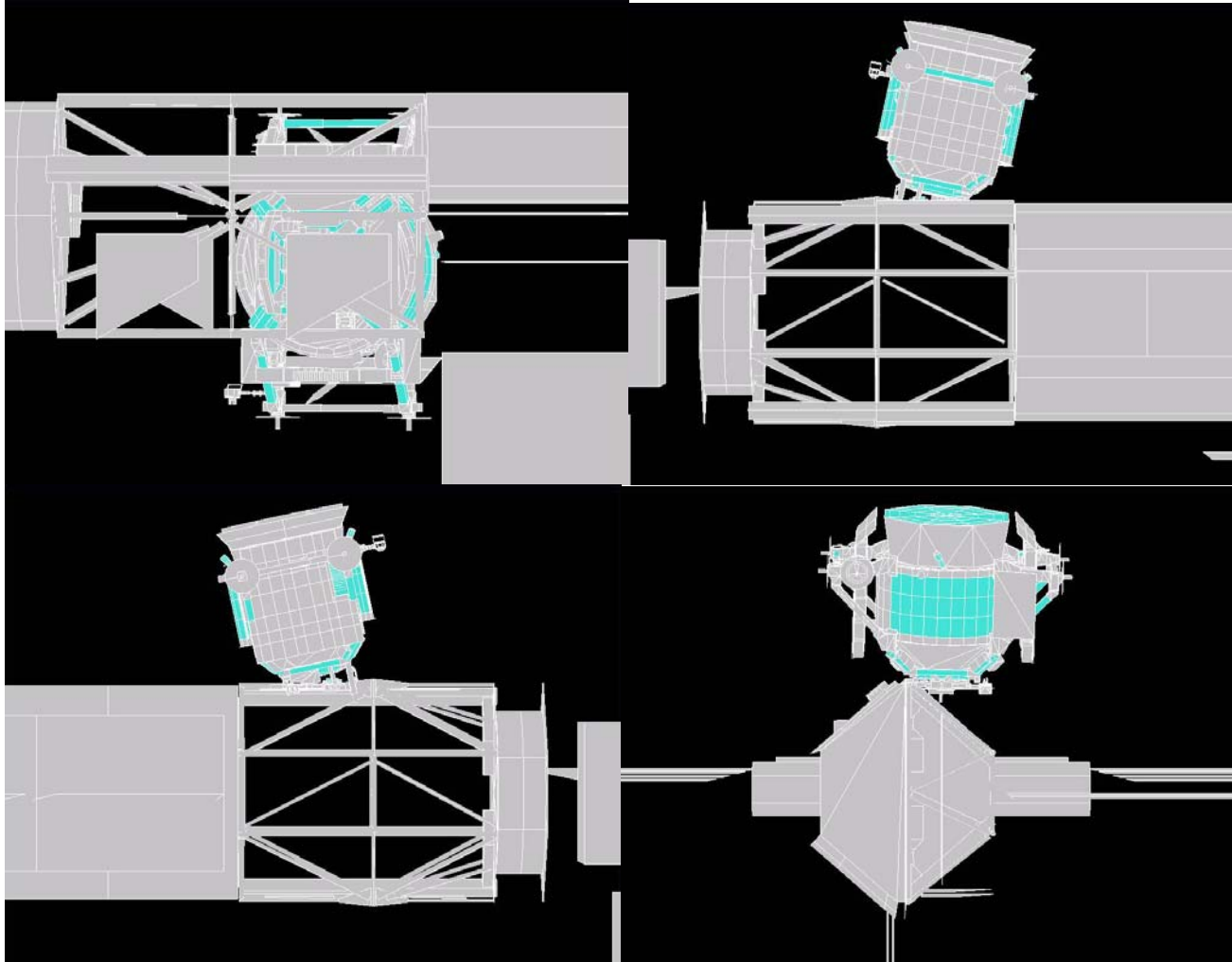


Figure 3.4.1.1.6-2-AMS: AMS Surfaces with Specularity Greater than 10% (shown in Green)

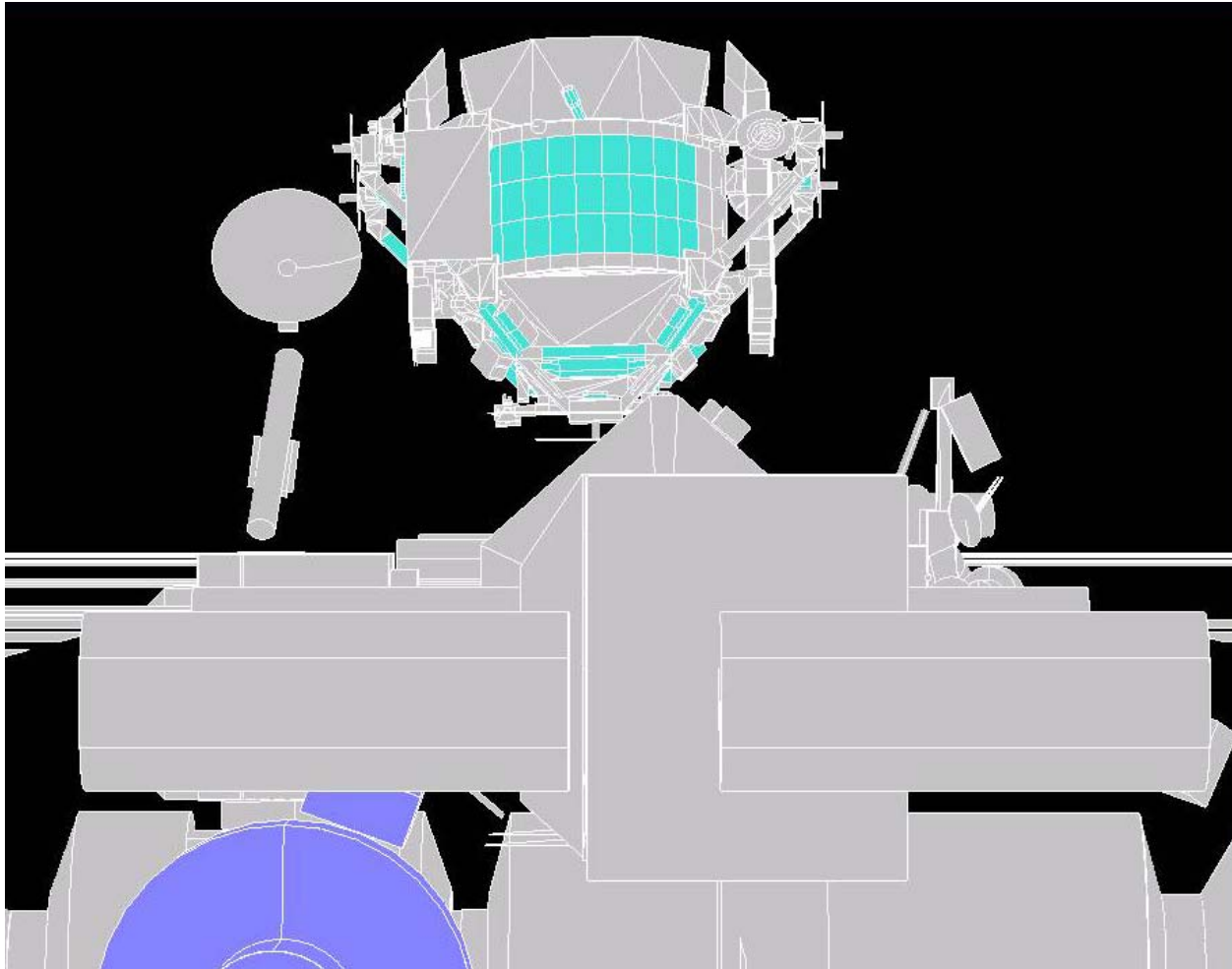


Figure 3.4.1.1.6-3-AMS: AMS Surfaces with Specularity Greater than 10% (shown in Green)

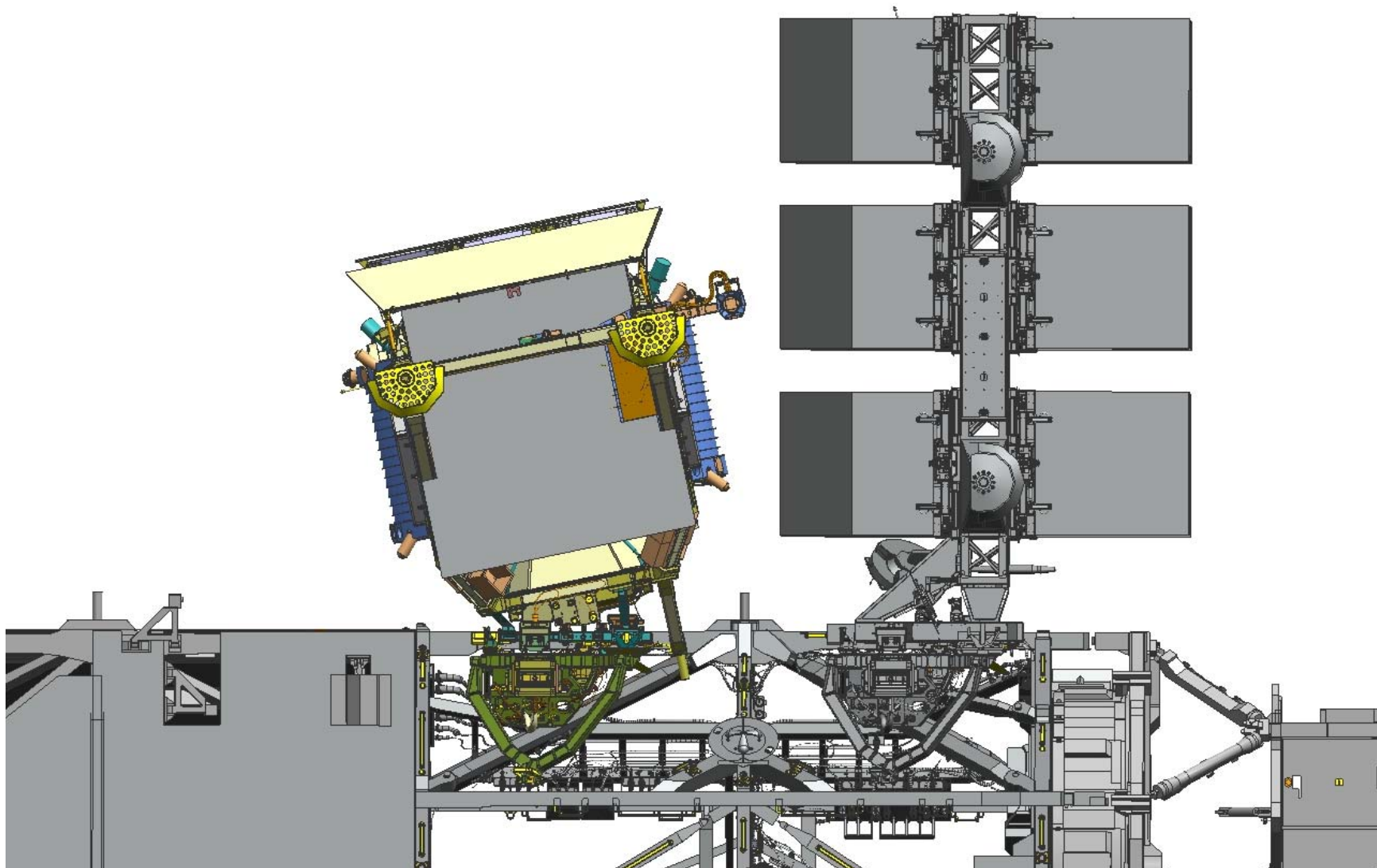


Figure 3.4.1.1.6-4-AMS: and ELC

Rationale:

For thermal reasons, the AMS payload was forced to put silver Teflon on numerous surfaces across the AMS support structure. Silver Teflon is specular and some of these surfaces have a view factor to the neighboring ISS surface or Attached Payload.

All specular surfaces on the AMS are convex or flat, therefore the specular surfaces will not impose a focused, high magnitude solar flux on the ISS.

Only LVLH attitudes (+/- 15 degrees roll, pitch, and yaw) are approved for nominal ISS operations. For most surfaces, areas of reflected flux are fast-moving in LVLH attitudes, and do not impinge on any area long enough to significantly raise the temperature. New inertial attitudes will still be analyzed or assessed according to the current processes.

Based on possible AMS locations, the only nearby surfaces will belong to an attached payload carrier, which are only at risk when the AMS receives sunlight in the direction of the carrier. These carriers will obscure, to a varying extent, the AMS from the incoming sun vector and reduce the potential for reflections.

The parallel ribs along the specular cylindrical face of the AMS help mitigate specularly.

PEI Analysis:

Specularity is a measure of a surfaces mirror like properties. When you shine a light on a mirror, the angle of reflection equals the angle of incidence. Specularity is the percentage of the incident light that is reflected at the angle of incidence.

AMS was required to use Silver Teflon to provide the needed temperature control. AMS uses a small amount of embossed silver Teflon and the rest is non-embossed. The specularity of silver Teflon is 65% of 94% for embossed and 84% of 96% for non-embossed which is above allowable limit of 10%. There are other surface finishes with similar thermal properties that meet the specularity requirements but none are known that can be incorporated into a thermal blanket. Use of Z93 paint (specularity of ~8-9%) would require that AMS be redesigned to incorporate a hard outer shell in addition to it's thermal blanket.

The use of silver Teflon presents thermal problems for integrating other hardware around AMS. These problems are minimized by the location of the AMS and by the shape of AMS. AMS's location is such that it only receives direct sunlight a small portion of the time. The shape of AMS is convex. Convex shapes diffuse reduce the overall specularity of reflected sunlight.

The use of silver Teflon by AMS will have an impact on ELC. However because of the shape and location of AMS, the impact is small. The impact will be evaluated as part of normal business during ISS level analysis.

The impact to ELC of Silver Teflon on AMS is over shadowed by the presence of AMS. No matter what the surface properties, any large structure, as the AMS is, will have a large impact on ELC. Per PTCS, for half the orbital attitudes, AMS will keep ELC cooler by blocking the sun. In a minority of cases where

energy is bounced back and forth between AMS and ELC, the presence of an AMS will make the ELC hotter. All of these cases and conditions will be handled by PTCS as part of normal business.

The controlling ISS System, Passive Thermal Control System (PTCS), has approved this exception in their regular meeting, the PTCS forum.

PEI Recommendation:

PEI recommends approving as written.

Operational Constraints: (As Needed)

None identified by PEI

PTR Recommendation:

Approve as written.

PCB Disposition:

Approve as written.